1892MNRAS..52..548G

Orbit of the Double Star κ Pegasi A C.

By Professor S. Glasenapp.

(*Communicated by S. W. Burnham.*)

In 1880 Mr. S. W. Burnham, M.A., discovered the duplicity of the large star of the binary κ *Pegasi* ($\alpha = 21^{h}\ 39^{m}\cdot7$, $\delta = +25^\circ\ 8'$ for 1890). The new companion (C) has been observed only by Mr. Burnham and by the late R. Engelmann; no other observations have been published. The following observations have been kindly communicated to me by Mr. S. W. Burnham:—

T	θ	ρ	Observer.
	°	″	
1880·68	137·9	0·27	β 4*n*
83·02	116·0	0·16	En 1*n*
84·01	140·0	0·25	En 1*n*
84·87	104·7	0·22	β 1*n*
88·78	274·7	0·23	β 3*n*
89·51	262·3	0·14	β 4*n*
90·57	187·1	0·10	β 4*n*
91·61	150·0	0·10	β 3*n*
91·81	144·6	0·13	β 4*n*
92·36	135·1	0·17	β 1*n*

For the investigation of the orbit we take a simple mean of the three observations, made in 1883 and 1884 by Engelmann and Burnham; in this manner we obtain for 1883·97 a mean position $\theta = 120^\circ 2$ and $\rho = 0''\cdot21$. It would be better perhaps to reject the observation of Engelmann made in 1884, but as the value of the measures can be estimated only after the investigation of the orbit, we retain it.

The following table, therefore, embraces all the measured positions:—

T	θ	ρ	T	θ	ρ
	°	″		°	″
1880·68	137·9	0·27	1890·57	187·1	0·10
83·97	120·2	0·21	91·61	150·0	0·10
88·78	274·7	0·23	91·81	144·6	0·13
89·51	262·3	0·14	92·36	135·1	0·17

It is evident that the satellite has described a whole revolution; the elements of the orbit can therefore be determined with satisfactory precision. By the graphical method we very easily obtain the following system of elements:—

1892MNRAS..52..548G

$T = 1898{\cdot}8$ $\lambda = 199{\cdot}9$
$U = 11{\cdot}54$ years $(n = -31^{\circ}\,196)$ $e = 0{\cdot}28$ $(\phi = 16^{\circ}{\cdot}26)$
$\Omega = 133^{\circ}{\cdot}0$ $a = 0''{\cdot}21$
$i = 71^{\circ}{\cdot}6$

and then the corrections of Ω, i and ϕ, namely: $d\Omega = -7^{\circ}{\cdot}34$, $di = -5^{\circ}{\cdot}62$, and $d\phi = -4^{\circ}{\cdot}723$, so that the most probable system of elements will be

$T = 1898{\cdot}8$ $\lambda = 199{\cdot}90$
$U = 11{\cdot}54$ years $(n = -31^{\circ}{\cdot}196)$ $e = 0{\cdot}20$ $(\phi = 11^{\circ}{\cdot}537)$
$\Omega = 125^{\circ}{\cdot}66$ $a = 0''{\cdot}21$
$i = 65^{\circ}{\cdot}98$

The comparison of these elements with the observations is given in the following table:—

T	θ_o	θ_c	$\theta_o - \theta_c$	ρ_o	ρ_c	$\rho_o - \rho_c$
	°	°	°	″	″	″
1880·68	137·9	142·8	− 4·9	0·27	0·21	+ 0·06
83·97	120·2	109·0	+ 11·2	0·21	0·19	+ 0·02
88·78	274·7	281·8	− 7·1	0·23	0·14	+ 0·09
89·51	262·3	252·1	+ 10·2	0·14	0·10	+ 0·04
90·57	187·1	184·2	+ 2·9	0·10	0·13	− 0·03
91·61	150·0	152·1	− 2·1	0·10	0·17	− 0·07
91·81	144·6	148·7	− 4·1	0·13	0·18	− 0·05
92·36	135·1	141·1	− 6·0	0·17	0·21	− 0·04

The element λ (distance between the node and the periastron) could not be determined with great exactitude, because there are only two observations of the satellite in 1888 and 1889 from which it can be determined.

In the differences between the calculated and observed distances we remark a singular relation; all the distances measured before 1890 are larger than the calculated, and all the distances measured after 1890 are smaller. This might be supposed to indicate defective elements of the orbit, but it may be explained by the fact that the earlier observations were made with smaller telescopes than the later ones, for distances are always measured too great with small telescopes.

The star is very close, and can be observed only with large telescopes; it belongs to the class of binaries of very short period, its period being one of only 11·5 years.

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1892MNRAS..52..548G

The Orbit of OΣ 269. By J. E. Gore.

A measure made by Mr. Burnham last year, of this close and difficult double star, discovered by O. Struve in 1844, shows that one revolution had then been nearly completed. I have computed the orbit and find the following provisional elements :—

Elements of OΣ 269.

$P = 47{\cdot}70$ years. $☊ = 51^\circ\ 56'$
$T = 1883{\cdot}12$ $\lambda = 43^\circ\ 30'{\cdot}5$
$e = 0{\cdot}0575$ $\mu = +7^\circ{\cdot}547$
$i = 82^\circ\ 48'{\cdot}7$ $a = 0''{\cdot}58$

These elements are remarkable for the high inclination and small eccentricity of the real orbit, an eccentricity very unusual in binary stars. The apparent ellipse I find very much resembles that given by Mr. Burnham in the *Observatory* for 1891 July, but is more elongated.

The following is a comparison between the above elements and the measures used in computing the orbit :—

Epoch.	Observer.	θ_o	θ_c	$\theta_o-\theta_c$	ρ_c	ρ_c	$\rho_o-\rho_o$
		°	°	°	″	″	″
1844·31	O. Struve	218·0	218·0	0·0	0·33	0·26	+0·07
1846·39	,,	223·8	224·2	−0·4	0·39	0·39	0·0
1851·39	,,	228·9	230·6	−1·7	0·33	0·59	−0·26
1861·26	,,	242·8	242·8	0·0	0·33	0·34	−0·01
1883·41	Engelmann	61·4	60·1	+1·3	0·22	0·36	−0·14
1891·26	Burnham	213·4	213·4	0·0	0·22	0·21	+0·01

On the assumption that the mass of the system is equal to the mass of the Sun, the "hypothetical parallax" would be

$$p = \frac{a}{P^{\frac{2}{3}}} = 0''{\cdot}044$$

According to the Draper Catalogue of Stellar Spectra the spectrum of the star is of the first type (A).

According to Burnham the magnitudes of the components are 7·2 and 7·7. The star is *Lalande* 25074, and its position for 1900 is

R.A. $13^h\ 28^m{\cdot}3$
Decl. $+35^\circ\ 25'$